Managing Risk for the California Bay-Delta, the Multiple Sources-Stressors-Habitats-Endpoints (MSSHE) Paradigm and Implementation of Adaptive Management

Wayne G. Landis
Western Washington University
Institute of Environmental Toxicology
Last talk and last day-----thanks for coming!

The sunset is almost here....
I will try to make it interesting with a story about dealing with multiple stressors, the probabilities of effects....
...and a with a forest fire to the south with a temporary flight restriction

The altitude are up to 8,000 ft.
WE did make it home by using an adaptive management decision making approach.
Flying from Spokane, Washington to Bellingham - Thunderstorms and Forest Fires, and mountains.
And the flight was full of using adaptive management to make decisions and choose alternatives.
We used an adaptive management approach to get home-the OODA Loop

If your OODA loop time is slower than the unfolding events, you will loose.

"OODA.Boyd" by Patrick Edwin Moran - Own work. Licensed under CC BY 3.0 via Wikimedia Commons - http://commons.wikimedia.org/wiki/File:OODA.Boyd.svg#/media/File:OODA.Boyd.svg
Outline

Adaptive Management

Dealing with multiple stressors and making predictions

The Bay-Delta as an application of the process
The Observe-Orient-Decide and Act Loop is also found in environmental management. Notice any similarity to the previous process?
Adaptive management is supposed to be a quantitative process..

The Bay-Delta is the same as many other sites.

The Sacramento Bay-San Joaquin Delta has

Multiple Sources, Stressors, Habitats, and Endpoints

or

MSSHE
The Bay-Delta as an opportunity

- An infrastructure exists
- Research and Monitoring are ongoing
- There are clear stakeholders, a science panel, and resources.
- An quantitative adaptive management approach has potential to enhance the overall process.
The Bay-Delta as an opportunity

- There are a number of questions and issues relating to the use of adaptive management (https://mavensnotebook.com/2016/03/17/improving-adaptive-management-in-the-sacramento-san-joaquin-delta/)
We have proposed additional approaches to inform adaptive management.

You have heard of this paper during the meeting.

Just out--eDNA, multiple stressors, machine learning and making predictions.
Adaptive Management and Risk Assessment


**Societal Constraints**

- **Social goals** (economic, cultural, well-being) that correspond to the multiple resources at a site.
- Constraints due to economic resources, benefits, social concerns, and legislation

**Ecological risk assessment**

- Data from the monitoring activities
- Inputs to the monitoring program describing the outcomes from the remediation options
- Evaluation of management and remediation options
- Estimates of risk to multiple endpoints across the management region

**Research, Engineering, Risk Assessment and Management**

- Derivation of the endpoints considered in the risk assessment and the criteria to be met in a spatially explicit context

**Public Engagement and Governance**

**Change in Externalities**

- Change in Externalities: Alterations in environmental conditions outside the management loop such as climate change, population growth, economics, technology

**The LOOP**
Adaptive Management and Risk Assessment


Social goals (economic, cultural, well-being) that correspond to the multiple resources at a site.

Ecological risk assessment:

- Constraints
- Derivation of the endpoints

Management and remediation options:

- Inputs describing the potential outcomes from the remediation with measurements (monitoring)
- Estimates of risk to multiple endpoints across the management region.

Decision making

Regulations, funding, legislature, Leadership Council, business plans, conflicting goals, Tribes.
Adaptive Management and Risk Assessment and the applications of quantitative tools.
We use Bayesian networks to describe causality between multiple sources, stressors, habitats and endpoints.

Conceptual model of cause and effect

The BN that describe and quantifies the predictions
Given enough data we can use case learning to quantify the relationships and to make predictions.
Is it possible to incorporate adaptive management to the Sacramento Bay-Delta region?

- It seems that the tools can be applied
- Would inform monitoring programs
- Not sure of stakeholder buy-in
Thanks for coming and safe travels!!